CLAIMS

1. A tray retainer for holding a tray stack having a plurality of trays that are configured to carry microelectronic devices, comprising:

a guide structure having a first region, a second region spaced apart from the first region, a first channel section extending in a direction of a load/unload path between the first and second regions, and a second channel section extending in the direction of the load/unload path between the first and second regions, the second channel section facing the first channel section;

a cross-member extending transverse to the load/unload path and at least partially across the first region of the guide structure between the first and second channel sections; and

a moveable retaining element positioned at the second region of the guide structure, the retaining element being moveable to a storage position in which the retaining element projects a first distance transverse to the load/unload path into the guide structure, and the retaining element being moveable to a load/unload position in which the retaining element either does not project into the retaining assembly or projects a second distance less than the first distance.

2. The tray retainer of claim 1 wherein:

the guide structure comprises a frame having a bearing plate with a first end and a second end, a plurality of elongated L-shaped channel members attached to the first and second ends of the bearing plate, and panels attached to the channel members and/or the bearing plate, the channel members including first and second channel members attached to the first end of the bearing plate defining the first channel section and third and fourth channel members attached to the second end of the bearing plate defining the second channel section, wherein the channel members project from the bearing plate in the direction of the load/unload path, and wherein the first channel member faces the third channel member and the second channel member faces the fourth channel member;

the tray retainer further includes a lock/release mechanism coupled to the guide structure, the cross-member and the retaining element, the lock/release mechanism including at least one shaft coupled to the retaining element, an actuator coupled to the shaft, and a lock bearing coupled to the cross-member, the shaft having a sleeve with a contact portion, a bore and a slot, and the shaft also having a through-pin slidably received in the bore of the sleeve, and the shaft further having a key attached to the through-pin and received slot of the sleeve, the key rotating the sleeve with rotation of the through-pin, the actuator having a pulley attached to one end of the though pin, a drive cylinder and a belt engaging the drive cylinder and the pulley, and the lock bearing having a resilient engagement member to selectively engage the contact portion of the sleeve, wherein an operator rotates the drive shaft to rotate the through-pin, sleeve and retaining element between the storage position and the load/unload position; and

the cross-member comprises a moveable plate.

3. The tray retainer of claim 1 wherein the guide structure comprises a frame having a bearing plate with a first end and a second end, a plurality of elongated L-shaped channel members attached to the first and second ends of the bearing plate, and panels attached to the channel members and/or the bearing plate, the channel members including first and second channel members attached to the first end of the bearing plate defining the first channel section and third and fourth channel members attached to the second end of the bearing plate defining the second channel section, wherein the channel members project from the bearing plate in the direction of the load/unload path, and the first channel member faces the third channel member and the second channel member faces the fourth channel member.

4. The tray retainer of claim 1 wherein:

the first channel section comprises a first C-shaped channel member, and the second channel section comprises a second C-shaped channel member; and

the cross-member comprises a plate having a first end attached to the first C-shaped channel member and a second end attached to the second C-shaped channel member.

5. The tray retainer of claim 1 wherein:

the first channel section comprises a first C-shaped channel member, and the second channel section comprises a second C-shaped channel member;

the cross-member comprises a floating plate extending at least partially between the first C-shaped channel member and the second C-shaped channel member, the floating plate being moveable along the load/unload path; and

the retaining element comprises a tab projecting into a cavity between the first and second C-shaped channel members in the storage position.

6. The tray retainer of claim 1 wherein:

the first channel section comprises first and second L-shaped channel members, and the second channel section comprises third and fourth L-shaped channel members; and

the cross-member comprises a plate having a first end attached to the first and second L-shaped channel members and a second end attached to the third and fourth L-shaped channel members.

7. The tray retainer of claim 1 wherein:

the first channel section comprises first and second L-shaped channel members, and the second channel section comprises third and fourth L-shaped channel members;

the cross-member comprises a floating plate extending at least partially between the first L-shaped channel member, the second L-shaped channel member, the third L-shaped channel member, and the fourth L-shaped channel member, the floating plate being moveable along the load/unload path; and

the retaining element comprises a tab projecting into a cavity between the first and second L-shaped channel members in the storage position.

8. The tray retainer of claim 1 wherein:

the guide structure comprises a unitary shell, and the first channel section is defined by a first end of the shell and the second channel section is defined by a second end of the shell; and

the cross-member comprises a plate attached to the shell.

9. The tray retainer of claim 1, further comprising a lock/release mechanism having an actuator, a shaft having a first end coupled to the retaining element and a second end coupled to the actuator, and a lock bearing attached to the cross-member and slidably receiving the shaft, the actuator rotating to rotate the retaining element between the storage position and the load/unload position and to rotate the shaft between a lock position and a release position relative to the lock bearing, the lock bearing preventing the cross-member from moving along the shaft when the shaft is in the lock position and the retaining element is in the storage position, and the lock bearing allowing the cross-member to move along the shaft when the shaft is in the release position and the retaining element is in the load/unload position.

10. The tray retainer of claim 1, further comprising a lock/release mechanism having an actuator and a shaft coupled to the actuator, the actuator having a drive cylinder and a belt contacting the drive cylinder, and the shaft having a through-pin including a first end coupled to the belt and a second end attached to the retaining element, a key attached to the through-pin proximate to the second end, and a sleeve having a bore receiving the through-pin and a slot receiving the key, wherein rotation of the drive cylinder rotates the through-pin and the sleeve to move the shaft between a lock position in which the retaining element is in the storage position and a release position in which the retaining element is in the load/unload position.

11. The tray retainer of claim 1 wherein:

the guide structure comprises a frame having a bearing plate and a plurality of channel members including at least a first channel member projecting from one end of the bearing plate and a second channel member projecting from another end of the bearing plate, the first channel member defining the first channel section of the guide structure and the second channel member defining the second channel section of the guide structure;

the retaining element comprises a tab; and

the tray retainer further comprising a lock/release mechanism having an actuator, a shaft coupled to the actuator, and a lock bearing slidably receiving the shaft and attached to the cross-member, wherein movement of the actuator to a first position moves shaft to a lock position in which the lock bearing engages the shaft to prevent the cross-member from moving along the shaft and in which the tab projects into a space between the first and second channel members in the storage position, and wherein movement of the actuator to a second position moves the shaft to a release position in which lock bearing disengages the shaft to allow the cross-member to move along the shaft and in which the tab is at least partially removed from the space between the first and second channel members in the load/unload position.

12. The tray retainer of claim 1, further comprising a lock/release assembly including:

a lock bearing attached to the cross-member, the lock bearing having a hole;

a shaft extending in the direction of the load/unload path, the shaft being slidably and rotatably received in the hole of the lock bearing, wherein at least one of the lock bearing and the shaft rotates between a lock position and a release position; and

an engagement assembly having an engagement element, a contact surface and a release surface, the engagement element being coupled to one of the shaft or the lock bearing, and the contact surface and the release surface being on the other of the shaft or the lock bearing, the contact surface being configured to contact the engagement

element and prevent axial movement between the lock bearing and the shaft in the lock position, and the release surface being configured to be spaced apart from the engagement element and allow axial movement between the lock bearing and the shaft in the release position.

13. The tray retainer of claim 12 wherein:

the shaft comprises a contoured elongated member having a flat section defining the release surface and a rounded outer section defining the contact surface, the rounded outer section having a curved outer surface with a diameter to fit within the hole of the lock bearing; and

the lock bearing comprises a hub having a cylindrical hole, an interior groove with in the hole, and a resilient member defining the engagement member in the groove, the flat section being juxtaposed to the resilient member in the release position and the outer section contacting the resilient member in the lock position.

14. The tray retainer of claim 12 wherein:

the shaft comprises an elongated member having a flat section defining the release surface and a plurality of truncated annular teeth defining the contact surface; and

the lock bearing comprises a hub having a cylindrical hole, a flat portion, and a slot in the flat portion defining the engagement element, the flat section of the shaft being juxtaposed to the flat portion of the lock bearing in the release position and at least one of the annular teeth being in the slot in the lock position.

15. A retainer for holding a tray stack having a plurality of trays configured to carry a plurality of microelectronic devices, comprising:

a casing having a guide structure with a first end, a second end, an interior holding area, and an opening at the second end of the guide structure for receiving the trays, the guide structure being configured to receive the tray stack and allow the tray stack to move along a load/unload path through the guide structure;

a cross-member member extending across at least a portion of the casing transverse to the load/unload path, the cross-member being spaced apart from the second end of the casing; and

a plurality of moveable retaining elements at least proximate to the second end, the retaining elements being moveable between a storage position in which the retaining elements project into the interior holding area of the guide structure to obstruct the load/unload path, and the retaining elements being moveable into a load/unload position in which the retaining elements are clear the load/unload path.

16. The retainer of claim 15 wherein:

the guide structure has a first channel section comprising a first C-shaped channel member and a second channel section comprising second C-shaped channel member; and

the cross-member comprises a plate having a first end attached to the first C-shaped channel member and a second end attached to the second C-shaped channel member.

17. The retainer of claim 15 wherein:

the guide structure has a first channel section comprising a first C-shaped channel member and a second channel section comprising a second C-shaped channel member;

the cross-member comprises a floating plate extending at least partially between the first C-shaped channel member and the second C-shaped channel member, the floating plate being moveable along the load/unload path; and

the retaining element comprises a tab projecting into a cavity between the first and second C-shaped channel members in the storage position.

18. The retainer of claim 15 wherein:

the guide structure has a first channel section comprising first and second L-shaped channel members and a second channel section comprising third and fourth L-shaped channel members; and

the cross-member comprises a plate having a first end attached to the first and second L-shaped channel members and a second end attached to the third and fourth L-shaped channel members.

19. The retainer of claim 15 wherein:

the guide structure has a first channel section comprising first and second L-shaped channel members and a second channel section comprising third and fourth L-shaped channel members;

the cross-member comprises a floating plate extending at least partially between the first L-shaped channel member, the second L-shaped channel member, the third L-shaped channel member, and the fourth L-shaped channel member, the floating plate being moveable along the load/unload path; and

the retaining element comprises a tab projecting into a cavity between the first and second L-shaped channel members in the storage position.

20. The retainer of claim 15, further comprising a lock/release assembly including:

a lock bearing attached to the cross-member, the lock bearing having a hole;

a shaft extending in the direction of the load/unload path, the shaft being slidably and rotatably received in the hole of the lock bearing, wherein at least one of the lock bearing and the shaft rotates between a lock position and a release position; and

an engagement assembly having an engagement element, a contact surface and a release surface, the engagement element being coupled to one of the shaft or the lock bearing, and the contact surface and the release surface being on the other of the shaft or the lock bearing, the contact surface being configured to contact the engagement

element and prevent axial movement between the lock bearing and the shaft in the lock position, and the release surface being configured to be spaced apart from the engagement element and allow axial movement between the lock bearing and the shaft in the release position.

21. A retainer for holding a tray stack having a plurality of trays that are configured to carry microelectronic devices, comprising:

a protective casing including a guide structure having a first guide section configured to receive a first side of the tray stack, a second guide section configured to receive a second side of the tray stack, the first and second guide sections defining an opening and an interior holding area configured to retain the tray stack in a stacked arrangement and to allow the tray stack to move through the guide structure;

a cross-member extending at least partially between the first and second guides sections; and

a plurality of moveable retaining elements in the casing at least proximate to the opening, the retaining elements being moveable between a storage position in which the retaining elements project into the opening and a load/unload position in which the retaining elements either do not project as far into the opening or are completely removed from the opening.

22. The retainer of claim 21 wherein:

the first channel section comprises a first C-shaped channel member, and the second channel section comprises a second C-shaped channel member; and

the cross-member comprises a plate having a first end attached to the first C-shaped channel member and a second end attached to the second C-shaped channel member.

23. The retainer of claim 21 wherein:

the first channel section comprises first and second L-shaped channel members, and the second channel section comprises third and fourth L-shaped channel members; and

the cross-member comprises a plate having a first end attached to the first and second L-shaped channel members and a second end attached to the third and fourth L-shaped channel members.

24. The retainer of claim 21, further comprising a lock/release assembly including:

a lock bearing attached to the cross-member, the lock bearing having a hole;

a shaft extending in the direction of the load/unload path, the shaft being slidably and rotatably received in the hole of the lock bearing, wherein at least one of the lock bearing and the shaft rotates between a lock position and a release position; and

an engagement assembly having an engagement element, a contact surface and a release surface, the engagement element being coupled to one of the shaft or the lock bearing, and the contact surface and the release surface being on the other of the shaft or the lock bearing, the contact surface being configured to contact the engagement element and prevent axial movement between the lock bearing and the shaft in the lock position, and the release surface being configured to be spaced apart from the engagement element and allow axial movement between the lock bearing and the shaft in the release position.

25. A retainer for holding a tray stack having a plurality of trays that are configured to carry microelectronic devices, comprising:

a housing having a frame and a plurality of panels attached to the frame, the frame including a first guide having an interior structure configured to moveably retain a first side of the tray stack, a second guide having an inner structure configured to moveably retain a second side of the tray stack, a bearing plate attached to an upper

section of the first and second guides to fix together the first and second guides, the panels being attached to the frame to define a cavity configured to receive the tray stack, and the panels defining an opening to the cavity opposite of the bearing plate through which the tray stack can pass into or out of the housing;

a quick release lock assembly coupled to the housing, the lock assembly having an actuator, a plurality of shafts coupled to the actuator and positioned in the housing to move between a first position and second position, and a retaining element attached to an end of each shaft at least proximate to the opening of the housing, the retaining elements moving with the shafts between a storage position when the shafts are in the first position and a load/unload position when the shafts are in the second position, wherein the retaining elements at least partially obstruct the opening in the storage position to hold trays of the tray stack in the housing, and the retaining elements do not obstruct the opening in the load/unload position to allow individual trays to pass through the opening; and

a floating plate slidably attached to the shafts, the floating plate driving the trays towards the opening when the retaining elements are in the load/unload position.

26. The retainer of claim 25 wherein the quick release lock assembly further comprises a plurality of lock bearings attached to the floating plate, the lock bearings each having a hole, and wherein the shafts extend in the direction of the load/unload path and each shaft is slidably and rotatably received in a hole of a corresponding lock bearing, wherein at least one of the lock bearings and the shafts rotate between a lock position and a release position.

27. The retainer of claim 26 wherein the lock bearing each further comprise an engagement assembly having an engagement element, a contact surface and a release surface, the engagement element being coupled to one of the shafts or the lock bearings, and the contact surface and the release surface being on the other of the shafts or the lock bearings.

28. The retainer of claim 27 wherein the contact surface is configured to contact the engagement element and prevent axial movement between the lock bearing and the shaft in the lock position, and the release surface is configured to be spaced apart from the engagement element and allow axial movement between the lock bearing and the shaft in the release position.

29. The retainer of claim 28 wherein:

the shafts each comprise a contoured elongated member having a flat section defining the release surface and a rounded outer section defining the contact surface, the rounded outer section having a curved outer surface with a diameter to fit within the hole of a corresponding lock bearing; and

the lock bearings each comprise a hub having a cylindrical hole, an interior groove within the hole, and a resilient member defining the engagement member in the groove, the flat section of a shaft being juxtaposed to the resilient member of a corresponding lock bearing in the release position and the outer section of the shaft contacting the resilient member of the corresponding lock bearing in the lock position.

30. The retainer of claim 28 wherein:

the shafts each comprise an elongated member having a flat section defining the release surface and a plurality of truncated annular teeth defining the contact surface; and

the lock bearings each comprise a hub having a hole, a flat portion, and a slot in the flat portion defining the engagement element, the flat section of a shaft being juxtaposed to the flat portion of a corresponding lock bearing in the release position and at least one of the annular teeth being in the slot in the lock position.

31. A retainer for holding a tray stack having a plurality of trays that are configured to carry microelectronic devices, comprising:

a casing having a guide structure with a first end and a second end, an interior holding area, and an opening at least proximate to the second end, the guide structure being configured to support the tray stack with respect to a load/unload path and to allow the tray stack to move through the guide structure along the load/unload path;

a plurality of moveable retaining elements at least proximate to the second end, the retaining elements being moveable between a storage position in which the retaining elements project into the interior holding area of the guide structure and a load/unload position in which the retaining elements either do not project as far into the interior holding area or are completely removed from the interior holding area; and

a floating plate moveably positioned in the casing to move along the load/unload path defined by the guide structure, the floating plate pushing the trays against the retaining elements when the retaining elements are in the storage position and the floating plate pushing the trays out of the casing when the retaining elements are in the load/unload position.

32. The retainer of claim 31 wherein:

the guide structure has a first channel section comprising a first C-shaped channel member and a second channel section comprising second C-shaped channel member; and

the floating plate has a first end adjacent to the first C-shaped channel member and a second end adjacent to the second C-shaped channel member.

33. The retainer of claim 31 wherein:

the guide structure has a first channel section comprising first and second L-shaped channel members and a second channel section comprising third and fourth L-shaped channel members; and

the floating plate has a first end adjacent to the first and second L-shaped channel members and a second end adjacent to the third and fourth L-shaped channel members.

34. The retainer of claim 31, further comprising a lock/release assembly including:

a lock bearing attached to the floating plate, the lock bearing having a hole;

a shaft extending in the direction of the load/unload path, the shaft being slidably and rotatably received in the hole of the lock bearing, wherein at least one of the lock bearing and the shaft rotates between a lock position and a release position; and

an engagement assembly having an engagement element, a contact surface and a release surface, the engagement element being coupled to one of the shaft or the lock bearing, and the contact surface and the release surface being on the other of the shaft or the lock bearing, the contact surface being configured to contact the engagement element and prevent axial movement between the lock bearing and the shaft in the lock position, and the release surface being configured to be spaced apart from the engagement element and allow axial movement between the lock bearing and the shaft in the release position.

35. A machine for processing microelectronic devices, comprising:

a receiving station having a platform with a tray singulator and a mounting element;

a removable tray retainer configured to hold a tray stack, the tray retainer having a guide structure including a first guide section and a second guide section, a cross-member extending at least partially between and transverse to the first and second guide sections, and a moveable retaining element spaced apart from the cross-member, the retaining element being moveable between a storage position in which the retaining element obstructs a load/unload path through the guide structure and a load/unload position in which the retaining element does not obstruct the load/unload path and also engages the mounting element to releasably hold the cassette to the platform; and

a processing station that processes the microelectronic devices.

36. The machine of claim 35 wherein the guide structure comprises a frame having a bearing plate with a first end and a second end, a plurality of elongated L-shaped channel members attached to the first and second ends of the bearing plate, and panels attached to the channel members and/or the bearing plate, the channel members including first and second channel members attached to the first end of the bearing plate defining the first channel section and third and fourth channel members attached to the second end of the bearing plate defining the second channel section, wherein the channel members project from the bearing plate in the direction of the load/unload path, and the first channel member faces the third channel member and the second channel member faces the fourth channel member.

37. The machine of claim 35 wherein:

the first channel section comprises a first C-shaped channel member, and the second channel section comprises a second C-shaped channel member; and

the cross-member comprises a plate having a first end attached to the first C-shaped channel member and a second end attached to the second C-shaped channel member.

38. The machine of claim 35 wherein:

the first channel section comprises a first C-shaped channel member, and the second channel section comprises a second C-shaped channel member;

the cross-member comprises a plate having a first end attached to the first C-shaped channel member and a second end attached to the second C-shaped channel member; and

the retaining element comprises a tab projecting into a cavity between the first and second C-shaped channel members in the storage position.

39. The machine of claim 35 wherein:

the first channel section comprises first and second L-shaped channel members, and the second channel section comprises third and fourth L-shaped channel members; and

the cross-member comprises a plate having a first end attached to the first and second L-shaped channel members and a second end attached to the third and fourth L-shaped channel members.

40. The machine of claim 35 wherein:

the first channel section comprises first and second L-shaped channel members, and the second channel section comprises third and fourth L-shaped channel members;

the cross-member comprises a plate having a first end attached to the first and second L-shaped channel members and a second end attached to the third and fourth L-shaped channel members; and

the retaining element comprises a tab projecting into a cavity between the first and second L-shaped channel members in the storage position.

41. The machine of claim 35 wherein:

the guide structure comprises a unitary shell, and the first channel section is defined by a first end of the shell and the second channel section is defined by a second end of the shell; and

the cross-member comprises a plate attached to the shell.

42. The machine of claim 35, further comprising a lock/release mechanism having an actuator, a shaft having a first end coupled to the retaining element and a second end coupled to the actuator, and a lock bearing attached to the cross-member and slidably receiving the shaft, the actuator rotating to rotate the retaining element between the storage position and the load/unload position and to rotate the shaft

between a lock position and a release position relative to the lock bearing, the lock bearing preventing the cross-member from moving along the shaft when the shaft is in the lock position and the retaining element is in the storage position, and the lock bearing allowing the cross-member to move along the shaft when the shaft is in the release position and the retaining element is in the load/unload position.

43. The machine of claim 35, further comprising a lock/release mechanism having an actuator and a shaft coupled to the actuator, the actuator having a drive cylinder and a belt contacting the drive cylinder, and the shaft having a through-pin including a first end coupled to the belt and a second end attached to the retaining element, a key attached to the through-pin proximate to the second end, and a sleeve having a bore receiving the through-pin and a slot receiving the key, wherein rotation of the drive cylinder rotates the through-pin and the sleeve to move the shaft between a lock position in which the retaining element is in the storage position and a release position in which the retaining element is in the load/unload position.

44. The machine of claim 35 wherein:

the guide structure comprises a frame having a bearing plate and a plurality of channel members including at least a first channel member projecting from one end of the bearing plate and a second channel member projecting from another end of the bearing plate, the first channel member defining the first channel section of the guide structure and the second channel member defining the second channel section of the guide structure;

the retaining element comprises a tab; and

the tray retainer further comprising a lock/release mechanism having an actuator, a shaft coupled to the actuator, and a lock bearing slidably receiving the shaft and attached to the cross-member, wherein movement of the actuator to a first position moves shaft to a lock position in which the lock bearing engages the shaft to prevent the cross-member from moving along the shaft and in which the tab projects into a space between the first and second channel members in the storage position, and wherein

movement of the actuator to a second position moves the shaft to a release position in which lock bearing disengages the shaft to allow the cross-member to move along the shaft and in which the tab is at least partially removed from the space between the first and second channel members in the load/unload position.

45. The machine of claim 35, further comprising a lock/release assembly including:

a lock bearing attached to the cross-member, the lock bearing having a hole;

a shaft extending in the direction of the load/unload path, the shaft being slidably and rotatably received in the hole of the lock bearing, wherein at least one of the lock bearing and the shaft rotates between a lock position and a release position; and

an engagement assembly having an engagement element, a contact surface and a release surface, the engagement element being coupled to one of the shaft or the lock bearing, and the contact surface and the release surface being on the other of the shaft or the lock bearing, the contact surface being configured to contact the engagement element and prevent axial movement between the lock bearing and the shaft in the lock position, and the release surface being configured to be spaced apart from the engagement element and allow axial movement between the lock bearing and the shaft in the release position.

46. The machine of claim 45 wherein:

the shaft comprises a contoured elongated member having a flat section defining the release surface and a rounded outer section defining the contact surface, the rounded outer section having a curved outer surface with a diameter to fit within the hole of the lock bearing; and

the lock bearing comprises a hub having a cylindrical hole, an interior groove with in the hole, and a resilient member defining the engagement member in the groove, the flat section being juxtaposed to the resilient member in the release position and the outer section contacting the resilient member in the lock position.

47. The machine of claim 45 wherein:

the shaft comprises an elongated member having a flat section defining the release surface and a plurality of truncated annular teeth defining the contact surface; and

the lock bearing comprises a hub having a cylindrical hole, a flat portion, and a slot in the flat portion defining the engagement element, the flat section of the shaft being juxtaposed to the flat portion of the lock bearing in the release position and at least one of the annular teeth being in the slot in the lock position.

48. A machine for processing microelectronic devices, comprising:

a stack of JEDEC trays, each JEDEC tray carrying a plurality of microelectronic devices;

a receiving station having a platform with a tray singulator and a mounting element, the tray singulator being configured to selectively separate and retain a single JEDEC tray from the stack of JEDEC trays;

a portable tray retainer configured to hold the stack of JEDEC trays, the tray retainer being releasably attached to the receiving station and the tray retainer including a casing and a plurality of retaining elements, wherein the casing includes a guide structure with a first end spaced apart from the receiving station and a second end proximate to the receiving station, a cross-member extending across at least a portion of the guide structure at least proximate to the first end, and an opening at least proximate to the second end through which the JEDEC trays can pass into or out of the casing, wherein the retaining elements are positioned proximate to the opening and are moveable between a storage position and a load/unload position, the retaining elements projecting into the guide structure in the storage position to hold the JEDEC trays in the retainer, and at least a portion of the retaining elements projecting away from the guide structure and engaging a corresponding mounting element of the receiving station in the load/unload position to allow the JEDEC trays to pass through the opening and to releasably hold the retainer to the receiving station, and wherein the cross-member is moveably positioned in the casing to move along a load/unload path to push a bottom tray

of the tray stack against the retaining elements when the retaining elements are in the storage position and to drive the bottom tray out of the casing to the singulator when the retaining elements are in the load/unload position; and

a processing station that processes microelectronic devices on JEDEC trays that have been unloaded from the retainer.

49. A lock/release assembly, comprising:

a lock bearing having a hole;

an elongated shaft slidably and rotatably received in the hole of the lock bearing, wherein at least one of the lock bearing and the shaft is rotatable between a lock position and a release position; and

an engagement assembly having an engagement element, a contact surface and a release surface, the engagement element being coupled to one of the shaft or the lock bearing, and the contact surface and the release surface being on the other of the shaft or the lock bearing, the contact surface being configured to contact the engagement element and prevent axial movement between the lock bearing and the shaft in the lock position, and the release surface being configured to be spaced apart from the engagement element and allow axial movement between the lock bearing and the shaft in the release position.

50. The lock/release assembly of claim 49 wherein:

the shaft comprises a contoured elongated member having a flat section defining the release surface and a rounded outer section defining the contact surface, the rounded outer section having a curved outer surface with a diameter to fit within the hole of the lock bearing; and

the lock bearing comprises a hub having a cylindrical hole, an interior groove with in the hole, and a resilient member defining the engagement member in the groove, the flat section being juxtaposed to the resilient member in the release position and the outer section contacting the resilient member in the lock position.

51. The lock/release assembly of claim 49 wherein:

the shaft comprises an elongated member having a flat section defining the release surface and a plurality of truncated annular teeth defining the contact surface; and

the lock bearing comprises a hub having a cylindrical hole, a flat portion, and a slot in the flat portion defining the engagement element, the flat section of the shaft being juxtaposed to the flat portion of the lock bearing in the release position and at least one of the annular teeth being in the slot in the lock position.

52. A method of storing a tray stack having a plurality of individual trays carrying microelectronic devices, the tray stack having a first exterior tray at one end of the tray stack and a second exterior tray at an opposite end of the tray stack, the method comprising:

inserting the tray stack along a load/unload path into a casing of a tray retaining device until the first exterior tray contacts a cross-member of the tray retaining device;

restricting the individual trays from moving laterally with respect to the load/unload path; and

selectively impeding movement along the load/unload path in a first direction by moving a retaining element attached to the tray retaining device from a load/unload position to a storage position, the retaining element allowing the tray stack to move along the load/unload path in the load/unload position and the retaining element engaging the second exterior tray in the storage position to impede movement of the tray stack along the load/unload path in a second direction.

53. The method of claim 52 wherein inserting the tray stack comprises positioning the retaining element in the load/unload position and sliding the tray stack along the load/unload path and into the casing.

54. The method of claim 52 wherein inserting the tray stack comprises attaching the tray retaining device to a processing station of a processing machine by positioning the retaining element in the load/unload position in which the retaining element engages a mounting element of the processing station and sliding the tray stack along the load/unload path and into the casing.

55. The method of claim 52 wherein:

the cross-member is a floating plate that is moveable along the load/unload path in the casing;

inserting the tray stack comprises attaching the tray retaining device to a processing station of a processing machine by positioning the retaining element in the load/unload position in which the retaining element engages a mounting element of the processing station and sliding the tray stack along the load/unload path and into the casing, the floating plate moving in the first direction; and

the method further comprises preventing the floating plate from moving when the retaining element is in the storage position and allowing the floating plate to move when the retaining element is in the load/unload position.

56. A method of storing a tray stack having a plurality of individual JEDEC trays carrying microelectronic devices, the tray stack having a first exterior tray at one end of the tray stack and a second exterior tray at an opposite end of the tray stack, the method comprising:

providing a portable tray retaining device configured to hold the stack of JEDEC trays, the tray retaining device including a casing, a plurality of retaining elements coupled to the casing and a driving element moveably coupled to the casing, wherein the casing includes a guide structure with a first end and a second end, a cross-member extending across at least a portion of the guide structure at least proximate to the first end, and an opening at least proximate to the second end through which the JEDEC trays can pass into or out of the casing, wherein the retaining elements are moveable

between a storage position and a load/unload position, the retaining elements projecting into the guide structure in the storage position to hold the JEDEC trays in the retainer, and the retaining elements projecting away from the guide structure in the load/unload position to allow the JEDEC trays to pass through the opening, and wherein the cross-member is moveably coupled to the casing to move along a load/unload path to push the tray stack toward the second end of the casing;

inserting the tray stack along the load/unload path into the casing; and

moving the retaining elements from the load/unload position to the storage position in which the retaining elements engage the second exterior tray and the cross-member engages the first exterior tray to restrict movement of the tray stack along the load/unload path.

57. The method of claim 56 wherein inserting the tray stack comprises positioning the retaining element in the load/unload position and sliding the tray stack along the load/unload path and into the casing.

58. The method of claim 56 wherein inserting the tray stack comprises attaching the tray retaining device to a processing station of a processing machine by positioning the retaining element in the load/unload position in which the retaining element engages a mounting element of the processing station and sliding the tray stack along the load/unload path and into the casing.

59. The method of claim 56 wherein:

the cross-member is a floating plate that is moveable along the load/unload path in the casing;

inserting the tray stack comprises attaching the tray retaining device to a processing station of a processing machine by positioning the retaining element in the load/unload position in which the retaining element engages a mounting element of the processing station and sliding the tray stack along the load/unload path and into the casing; and

the method further comprises preventing the floating plate from moving when the retaining element is in the storage position and allowing the floating plate to move when the retaining element is in the load/unload position.

60. A method of processing microelectronic devices in a tray stack having a plurality of individual trays carrying the microelectronic devices, the tray stack having a first exterior tray at one end of the tray stack and a second exterior tray at an opposite end of the tray stack, the method comprising:

inserting the tray stack along a load/unload path into a casing of a tray retaining device until the first exterior tray contacts a cross-member of the retaining device, the casing being configured to restrict the individual trays from moving laterally with respect to the load/unload path;

moving a retaining element attached to the tray retaining device from a load/unload position to a storage position, the retaining element allowing the tray stack to move along the load/unload path in the load/unload position and the retaining element engaging the second exterior tray in the storage position to restrict movement of the tray stack along the load/unload path;

releasably attaching the tray retaining device to the receiving station of the processing machine;

releasing the tray stack to move along the load/unload path by moving the retaining element from the storage position to the load/unload position to disengage the retaining element from the second exterior tray of the tray stack; and

separating individual trays from the tray stack and processing the microelectronic devices on the individual trays in the processing machine.

61. The method of claim 60 wherein releasably attaching the tray retention device to the receiving station occurs when the retaining element moves from the storage position to the load/unload position by engaging the retaining element with a mounting element attached to the processing machine.

62. The method of claim 60 wherein inserting the tray stack comprises positioning the retaining element in the load/unload position and sliding the tray stack along the load/unload path and into the casing.

63. The method of claim 60 wherein:

the cross-member is a floating plate that is moveable along the load/unload path in the casing; and

the method further comprises preventing the floating plate from moving when the retaining element is in the storage position and allowing the floating plate to move when the retaining element is in the load/unload position.